

How would you use mental math to solve these problems?

Girl Scout Troup Owlettes sold 346 boxes of cookies while Girl Scout Troup Falcons sold 147 boxes. If we put the totals together, how many boxes of cookies were sold?



The Robins started out with 102 boxes of Girl Scout cookies and by the end of the day, they had 76 boxes. How many boxes did they sell?

*Show your way of solving the problem on the window.
(Please do not write on window if someone already solved it your way).*



Tools and Techniques to Enhance K-2 Math Talks

Gwen Hancock, Coordinator, RCOE

“The highest form of pure thought is mathematics.”

- ❖ Plato recognized the importance of developing thinkers through the use of math.
- ❖ Are you looking for ways to grow math thinkers in your K-2 classroom?



Essential Question

- ❖ How can teachers develop math thinkers through implementing the practice of daily math talks using a variety of tools and problem solving strategies?
- ❖ How do we best enable students to explain their thinking and critique the reasoning of others?



Agenda

- ❖ What is a Math Talk?
- ❖ What do the Standards and Framework Say?
- ❖ How to Provide Opportunities to *Explain and Justify*.
- ❖ Which Strategies and Tools Work Best?
- ❖ Steps to Design a Purposeful Math Talk.

Let's Start Talking

Why is it important to have students discuss their thinking?



What is a Math Talk?

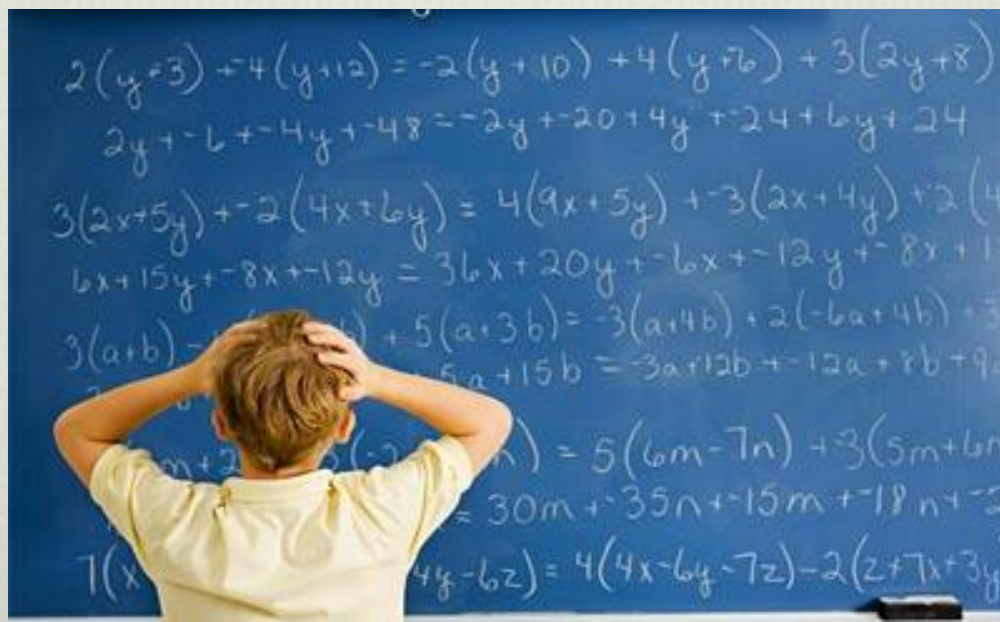
- ❖ Short ongoing conversations based around intentionally selected problems where students are encouraged to solve problems in ways that are meaningful to them
1. Teachers present the problem.
 2. Students individually figure out the answer.
 3. Students share their answers and their thinking.
 4. Class critiques the strategies and solution(s) for the problem.

Prescription for a Math Talk

- ❖ 5-10 minutes per day
- ❖ Encourage engagement of all students
 - ❖ Active Understanding
- ❖ Emphasize the process rather than only correct answers
- ❖ Promote oral discussion
- ❖ Multiple solutions
- ❖ Develop a web of connections between numbers and number facts

DO THEY KNOW WHY?

“Our classrooms are filled with students and adults who think of mathematics as rules and procedures to memorize without understanding the numerical relationships that provide the foundation for these rules.”



Why Math Talks?

- ❖ Mathematical problem solving is the hallmark of an effective mathematics program
 - ❖ Practice with a variety of problems and a grasp of techniques and the underlying principles allows students to use math in a flexible way to attack problems and devise different ways to solve them.
 - ❖ Gaps in knowledge and errors in reasoning can be identified when students *think aloud* or talk through their reasoning.
 - ❖ To prepare students for college and career teachers should plan for, instruct, model and support classroom talk, reflection and a positive disposition toward math.

Computational Fluency

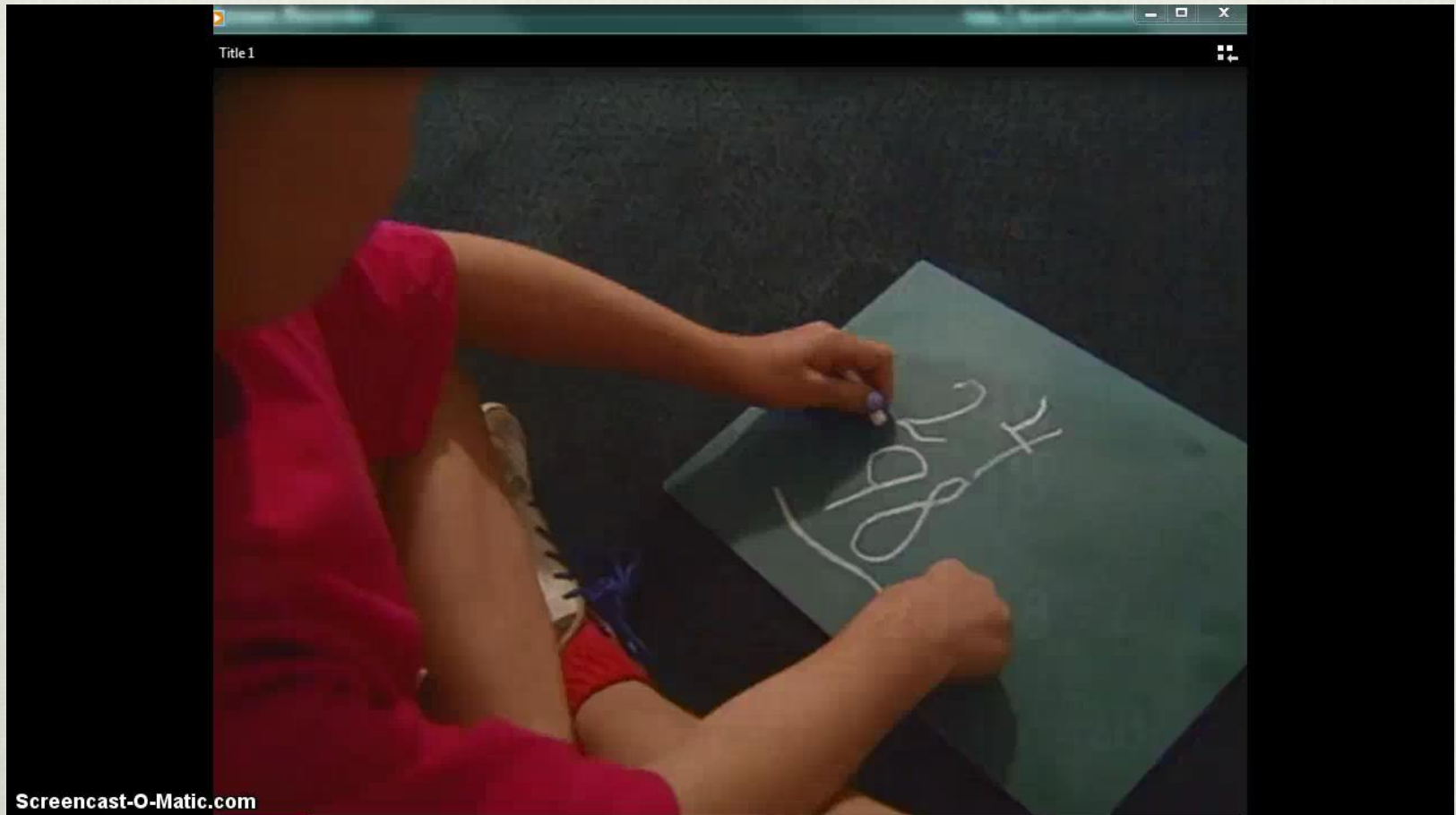
- ❖ Math Talks are a powerful tool to develop computational fluency
 - ❖ Need to know math concepts that go beyond basic facts or procedures
 - ❖ Numbers can be composed and decomposed
 - ❖ What we know about one number helps us figure out other numbers
 - ❖ What we know about numbers to 10 helps us with numbers to 100 and beyond
- ❖ Develop efficient and accurate methods of computing
- ❖ Demonstrate flexibility
- ❖ Understand and explain methods of solving problems
- ❖ Produce accurate answers efficiently



Overarching Goals

- ❖ Number Sense
- ❖ Place Value
- ❖ Fluency
- ❖ Properties
- ❖ Connecting Mathematical Ideas


Why Incorporate Math Talks?



Two SETS of Math Standards!



What?



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HOW?

Look for and structure.

8. Look for and in repeated rea

Standards for Mathematical Practice

1. Make sense of problems and persevere in solving.

2. Reason abstractly and quantitatively.

3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics.

5. Use appropriate tools strategically.

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

Why Tools?

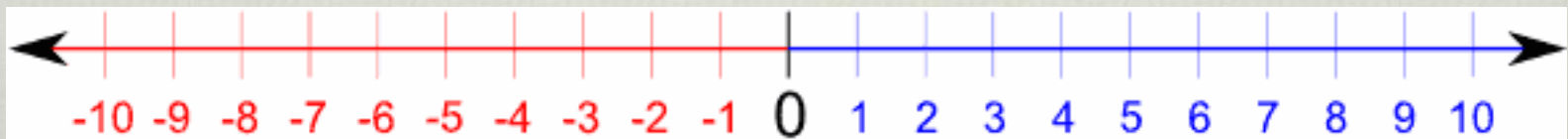
- ❖ Helps to develop number sense

“Awareness and understanding about what numbers are, their relationships, their magnitude, the effect of operating on numbers, including the use of mental mathematics and estimation.”

Fennis and Landis (1994)

- ❖ Assist students when thinking about a new concept

- ❖ Ex. Number lines and hundreds charts show magnitude of numbers and patterns in place value

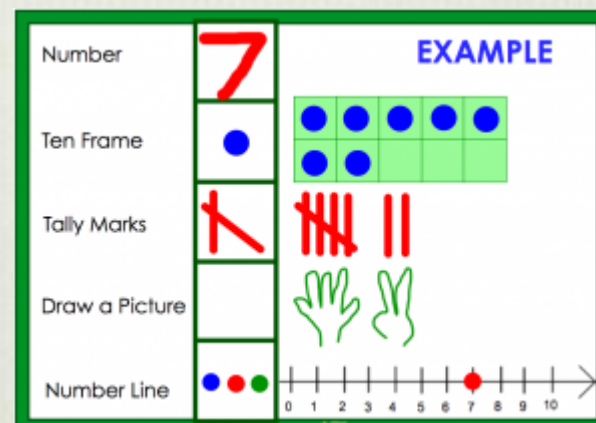


Which Tools?

- ❖ Teachers should consider available tools when presenting or solving a problem
- ❖ Students should be familiar with tools appropriate to their grade level
- ❖ Students should be able to make sound decisions about which tools would help solve a particular problem
- ❖ Tools (manipulatives/models) should be aides to thinking
 - ❖ Not used for demonstrating memorized procedures
 - ❖ Make manipulatives available but not mandatory

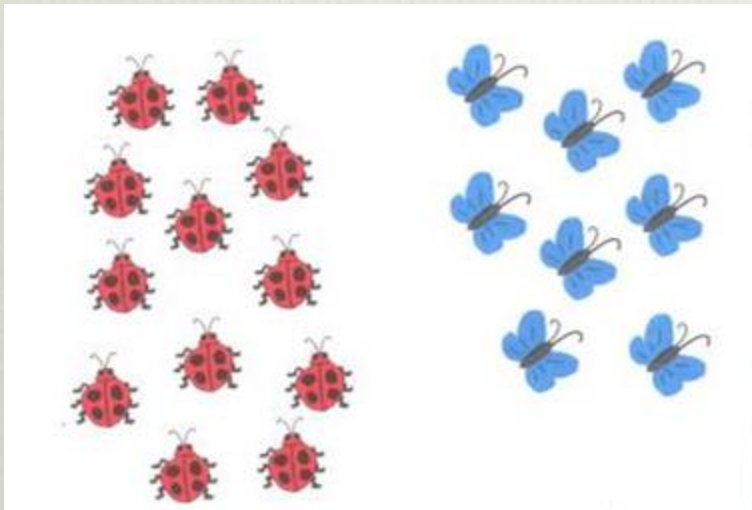
Math Talk Tools

- ❖ Dot Cards
- ❖ Two-color Counters
- ❖ Linking Cubes
- ❖ Rekenreks
- ❖ Five and Ten Frames
- ❖ Hundreds Chart
- ❖ Number Line
- ❖ Base 10 Blocks

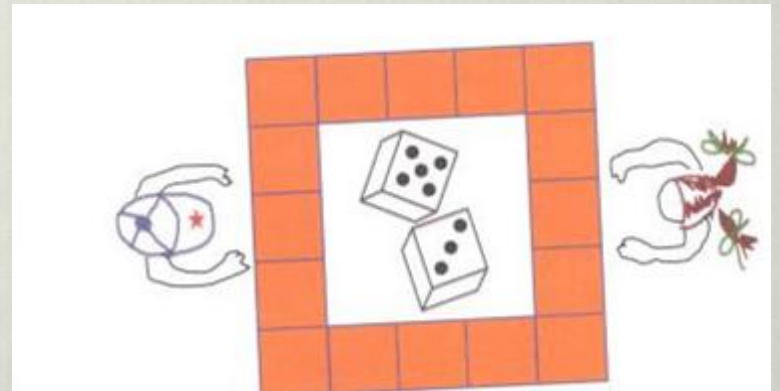


Tools Trigger Thinking

How many do you see?



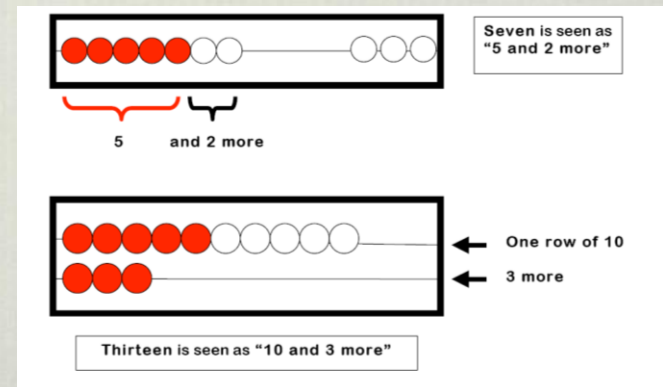
How do Maria and Miguel see the numbers differently?



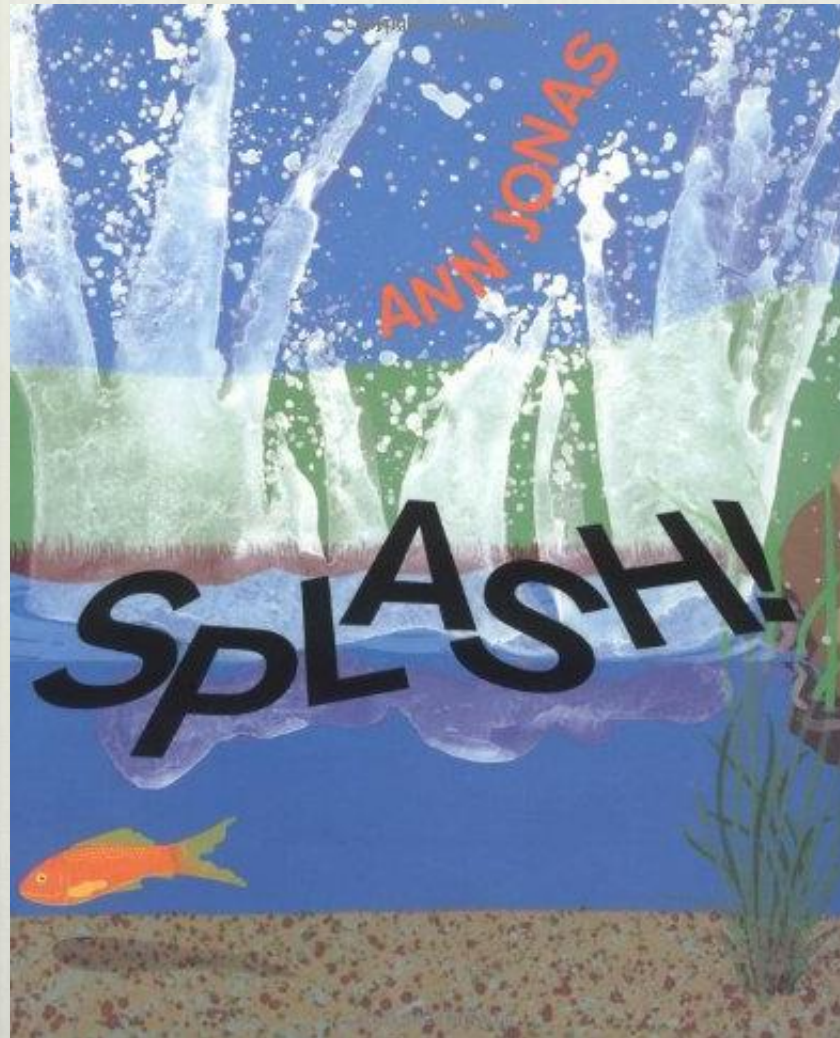
How do you see them?

Tools Track Thinking

- ❖ Rekenreks
 - ❖ Two rows of stringed beads with a repeating pattern of five beads of one color and five beads of another color on each row
 - ❖ Begin with first five colored beads to help students *subitize*
 - ❖ Use one row to build fluency to ten and two rows to build fluency to twenty



How Many are in the Pond?



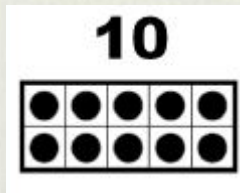
Addition Strategies

❖ Counting All / Counting On $1, 2, 3, 4, 5, 6$ or $6, 7, 8, 9, 10$

❖ Doubles / Near Doubles

$$6 + 7 = (6 + 6) + 1$$

❖ Making Tens



❖ Landmark or Friendly Numbers

❖ Compensation $19 + 6, 11 + 19$

$$19 + 1$$

$$19 + 15$$

$$19 + 27$$

$$19 + 18$$

❖ Break Each Number into its Place Value

$$(10 + 6) + (30 + 7)$$

$$26 + 10$$

$$26 + 30$$

$$26 + 50$$

$$26 + 53$$

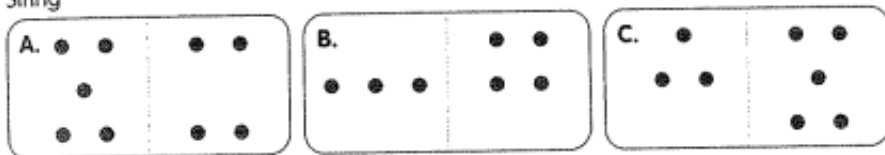
❖ Adding Up in Chunks

Why This String Choice?

Counting All/Counting On: Dot Images

As each number talk is shown, ask students, "How many dots do you see? How do you see them?"

String



Category 2: Making Tens

The following number talks include problems with two pairs of numbers that make a quick ten.

$$\begin{aligned}4 + 6 + 8 + 2 \\ 9 + 3 + 1 + 7 \\ 5 + 6 + 5 + 4\end{aligned}$$

$$\begin{aligned}3 + 8 + 2 + 7 \\ 4 + 4 + 6 + 6 \\ 9 + 1 + 1 + 9\end{aligned}$$

$$\begin{aligned}5 + 3 + 5 + 4 + 7 \\ 9 + 5 + 8 + 2 + 1 \\ 4 + 5 + 6 + 3 + 7\end{aligned}$$

Category 1: Adding Up in Chunks

The following number talks focus on adding multiples of ten to any number.

$$\begin{aligned}7 + 10 \\ 7 + 20 \\ 7 + 30 \\ 7 + 40\end{aligned}$$

$$\begin{aligned}23 + 10 \\ 23 + 20 \\ 23 + 40 \\ 23 + 50\end{aligned}$$

$$\begin{aligned}28 + 10 \\ 28 + 50 \\ 28 + 30 \\ 28 + 40\end{aligned}$$

Category 3: Removal

The following number talks use numbers that encourage removal in place-value chunks and decomposing a single-digit number to remove it in parts.

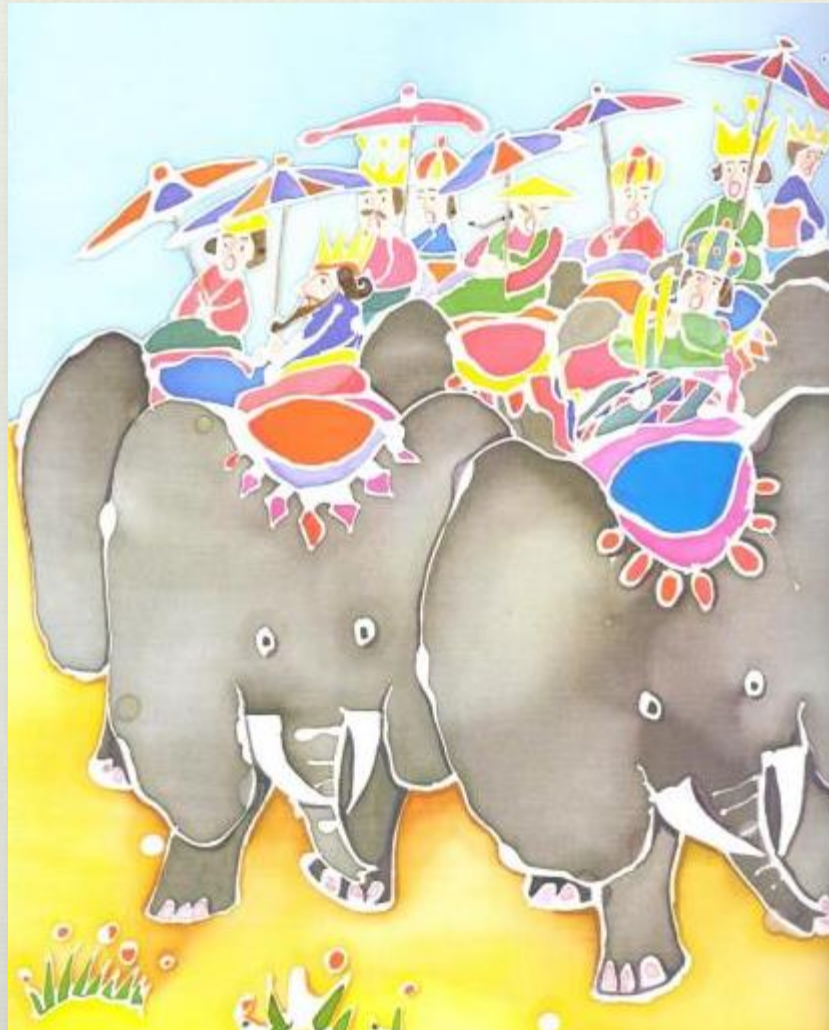
$$\begin{aligned}25 - 10 \\ 25 - 16 \\ 35 - 10 \\ 35 - 16\end{aligned}$$

$$\begin{aligned}23 - 10 \\ 23 - 15 \\ 36 - 10 \\ 36 - 19\end{aligned}$$

$$\begin{aligned}54 - 10 \\ 54 - 18 \\ 52 - 30 \\ 52 - 34\end{aligned}$$

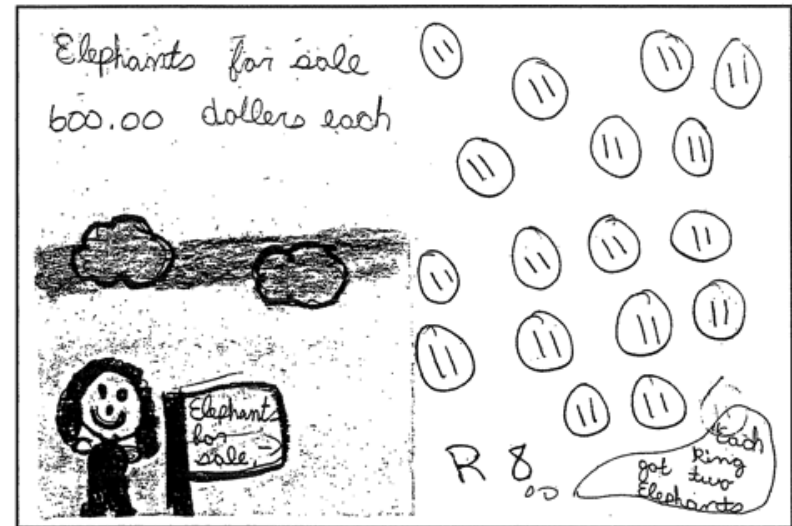
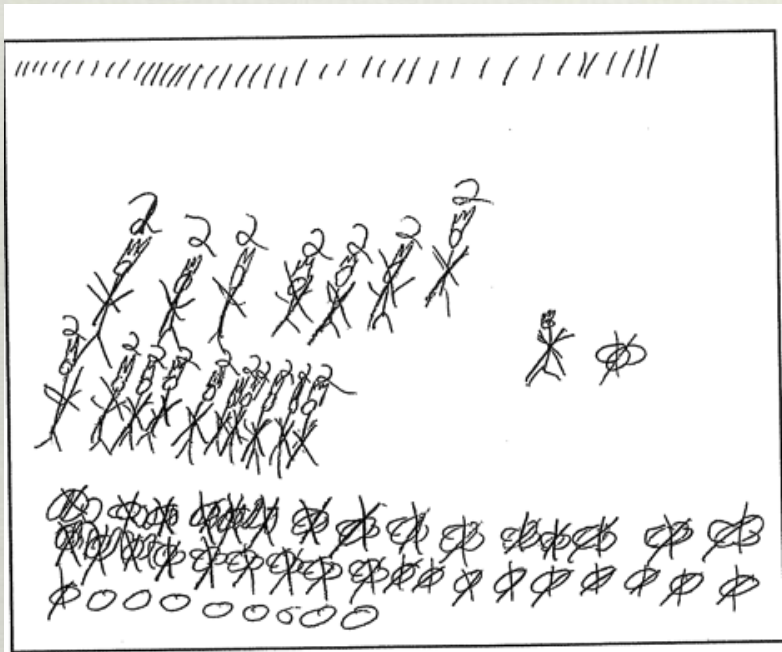
17 Kings and 42 Elephants

How will 17 kings share the work for caring for 42 elephants?



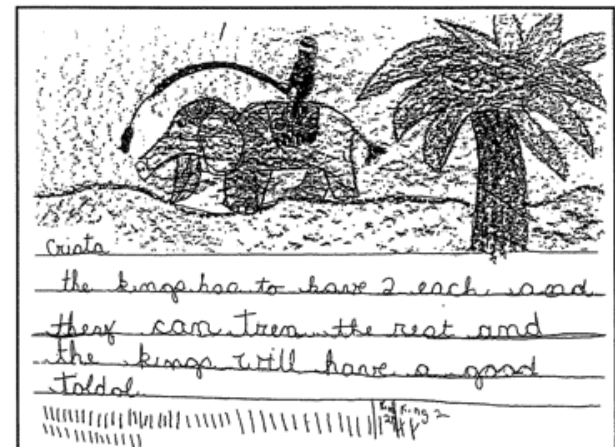
By Margaret Mahy
Patricia MacCarthy

Student Solutions



Lori Ann took an entrepreneurial approach to dealing with the extra elephants.

Crista's illustration shows her idea for coaxing an elephant to walk.



Merit Pay for Kings

I think that eight of the
most goodest kings will get
three elephants together with
ropes and all the other kings
will get 2 elephants and their
was nine kings had two elephants

Three elephants

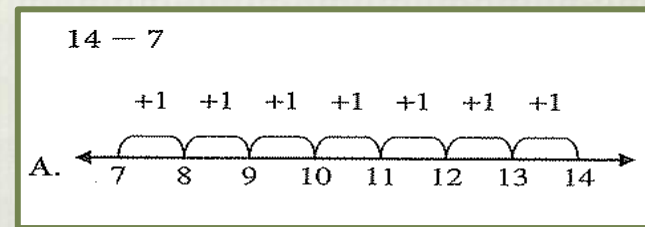
Two elephants

Subtraction Strategies

Subtraction = Finding the difference between two quantities

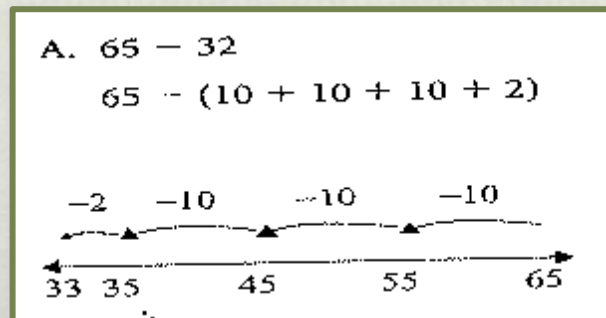
- Adding Up

Add up from the number being subtracted (subtrahend) to the whole number (minuend)



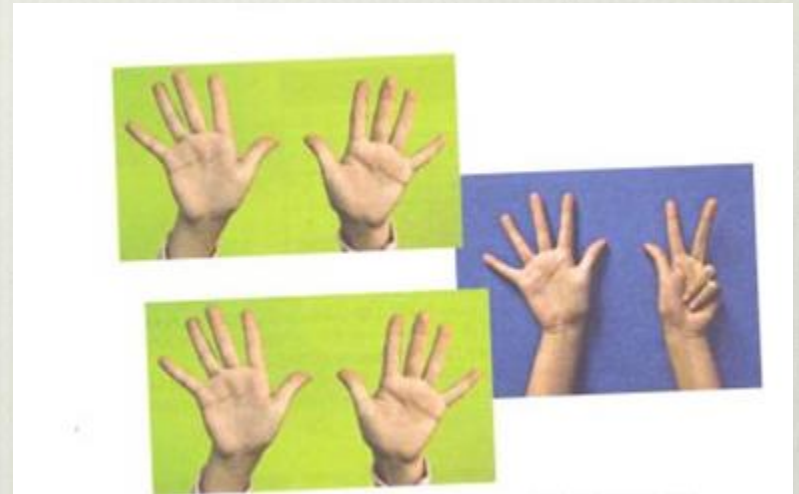
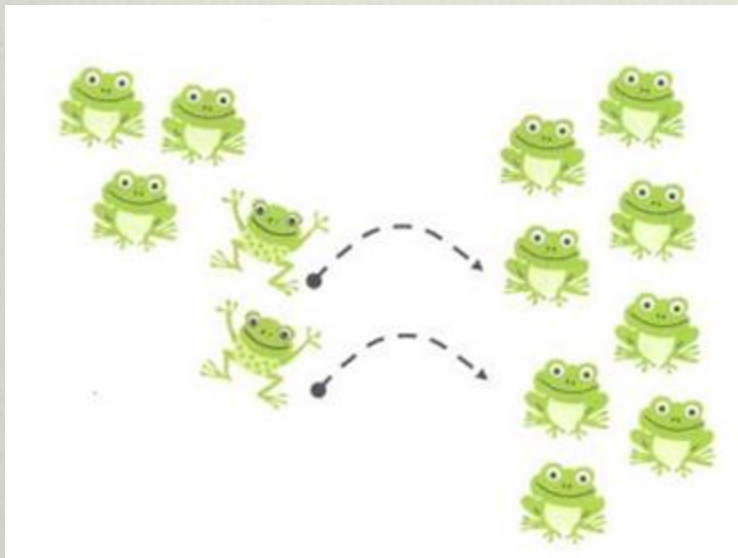
- Removal

Start with the minuend (whole) and remove the subtrahend in parts.



What Do You Notice About the Numbers?

Do you see the frogs the same or different after the two frogs move over?



When you take away an extra 10 fingers, what about the total changes? Why?

Trixie and Sadie sip tea in the tub. Trixie drinks 7 cups of tea and Sadie drinks 4 cups. How many more cups of tea does Trixie drink?



Teachers Grow Thinkers

- ❖ Do not teach specific strategies or procedures so students can think for themselves
- ❖ Carefully select types of problems that make number relationships evident to students
- ❖ Provide purposeful problems of varying degrees of difficulty
 - ❖ Allow students to solve problems in their own ways
 - ❖ Ensure every child is able to solve at least some of the problems correctly
 - ❖ Provide models/manipulatives for support

How Teachers Grow Thinkers

- ❖ Provide a safe environment
- ❖ Value student thinking
- ❖ Shift focus from , “See what I see,” to “What do YOU see?”
- ❖ Record, clarify and restate student thinking
- ❖ Figure out misconceptions or lack of proficiency and begin instruction at that point



What does a math talk look like?



* I agree with _____ because
_____.

* I do not understand _____.
Can you explain this again?

* I disagree with _____ because
_____.

* How did you decide to _____?

* Show how you know your answer
is correct.

Ways To Grow Talkers

- ❖ Encourage Engagement
 - ❖ Revoice – You are saying that...
 - ❖ Restate – Can you repeat what you heard in your own words?
 - ❖ Apply your own reasoning to critique the reasoning of others – Do you agree or disagree? Why?
 - ❖ Add on – Do you have something you can add to the discussion?
 - ❖ Wait – Expect and wait for someone to respond
 - ❖ Allows time for Els and strugglers to participate



Math Talk Essentials

1. Anticipate potential strategies and how students will respond
2. Chart and post student strategies
3. Use problems for exit tickets that review strategies discussed that day
4. Give a weekly assessment of problems similar to ones used in math talks that week. Ask them to solve problems in more than one way.

Number of the Day Math Talk

❖ 2nd Grade Classroom

❖ Student Tasks for Math Talks

1. Listen
2. Share
3. Write
4. Ask Questions
5. Check

- ❖ First 5 minutes to set up the problem
- ❖ Solve problem individually
- ❖ Share with table group, justify answers
- ❖ Watch video of 2nd graders solving the problem
- ❖ Students debrief and explain reasoning

Ask the right questions

- ❖ Who would like to share their thinking?
- ❖ What was the first thing your eyes saw or your brain did?
- ❖ How did you figure it out?
- ❖ Does your solution make sense?
- ❖ Who solved it the same way?
- ❖ Who did it another way?



Design a Purposeful Math Talk

1. Choose a content standard(s) – what are teaching Monday?
2. Choose a Standard(s) for Math Practice to develop the *how* of the content standard.
3. Plan a talk to support the conceptual understanding of the concept. Explore the stations around the room for ideas.
4. Which tools will help most?
5. How will you check for understanding?

Next Steps

- ❖ Name three things you learned today that you can implement in your classroom?
- ❖ How has your understanding of the importance of the number talks changed?
- ❖ How will you increase the use of the number talks to assist with the transition to the Common Core goal of developing conceptual understanding?



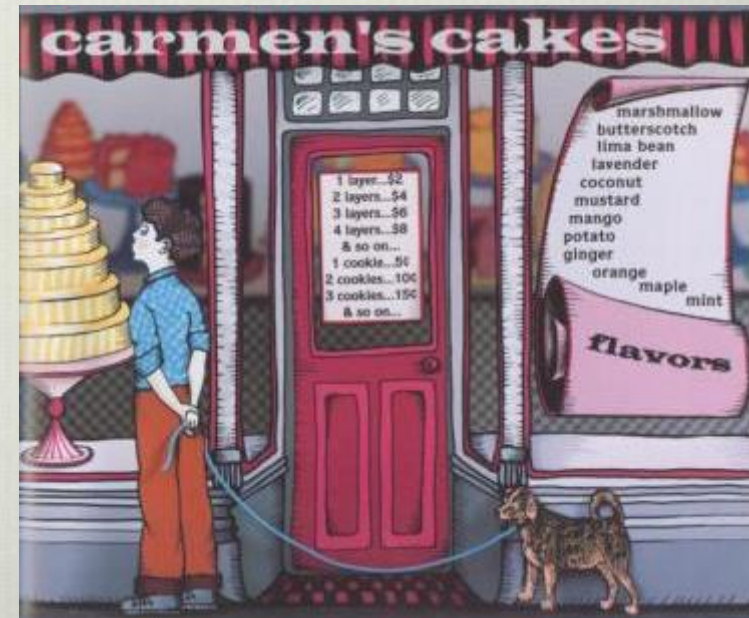
Job Description of a Teacher

Teachers must know their stuff,

They must know the pupils they intend to stuff,

And above all, they must stuff them artistically.

Max Sobel



Resources

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Resources

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- ❖ Small, Marian, and Amy Lin. *Eyes on Math: A Visual Approach to Teaching Math Concepts*. New York, NY: Teachers College Press, 2013. Print.
- ❖ *Thinking with Numbers: Number Talks*. Dir. Kathy Richardson. Didax, DVD.